Foodborne Disease Outbreaks

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To prevent transmission from infected persons.
2. To correct food-preparation practices that permit contamination with foodborne disease (FBD) agents.
3. To quickly remove from the commercial market a food product contaminated with a FBD pathogen and limit the spread of an outbreak.
4. To expand current understanding of the transmission, pathogenesis and community impact of illness caused by known FBD pathogens.
5. To identify new FBD agents, hazards, or gaps in the food safety system.

B. Legal Reporting Requirements

1. Health care providers: I**mmediately notifiable to local health jurisdiction**
2. Hospitals: I**mmediately notifiable to local health jurisdiction**
3. Laboratories: No requirements for reporting FBD outbreaks; see disease-specific reporting requirements
4. Local health jurisdictions: **Immediately notifiable to the Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES)**

C. Local Health Jurisdiction Investigation Responsibilities

1. **Immediately notify CDES when an outbreak is suspected.** DOH epidemiologists and food safety specialists are available to assist local health jurisdictions with FBD outbreak investigations as needed. CDES epidemiologists are responsible for coordinating the investigation of multi-county and multi-state FBD outbreaks involving Washington residents.
2. Facilitate the transport of specimens to Public Health Laboratories to assist with confirming an etiologic agent if necessary.
3. Perform both an epidemiologic and if indicated an environmental investigation for all FBD outbreaks.
4. Implement public health measures to prevent further spread.
5. Report all FBD outbreaks to CDES using the DOH Foodborne Illness Investigation Forms Part 1–3 available at:

   Part 1—Case Investigation: http://www.doh.wa.gov/notify/forms/foodoutbreak1.pdf

   Part 2—Field Investigation: http://www.doh.wa.gov/notify/forms/foodoutbreak2.pdf

   Part 3—Outbreak Summary Report: http://www.doh.wa.gov/notify/forms/foodoutbreak3.pdf

If Part 1 is not used during the investigation, Part 2 and Part 3 should be submitted.

2. THE EPIDEMIOLOGY OF FOODBORNE DISEASES

A. Etiologic Agents, Descriptions of Illness and Incubation Periods

Etiologic agents of FBD can be grouped into 5 general categories:

1. Preformed bacterial toxins (e.g., *Bacillus cereus* enterotoxin and diarrheal toxin, *Clostridium perfringens* toxin, *Staphylococcus aureus* toxin, *Clostridium botulinum* toxin)
2. Bacteria (e.g., *Shigella* spp., *Salmonella* spp., shiga toxin-producing *E. coli*, *Campylobacter jejuni*, *Listeria monocytogenes, Yersinia enterocolita, Vibrio* spp.)
3. Viruses (e.g., hepatitis A virus, norovirus)
4. Parasites (e.g., *Cryptosporidium*, *Cyclospora cayetanensis*, *Giardia*, *Trichinella)*
5. Noninfectious agents (e.g., metals, scombroid, mushroom toxins, shellfish toxins)

FBD most commonly manifests with abdominal cramps, vomiting, and/or diarrhea (bloody or non-bloody). However, for some agents, FBD can present with neurologic symptoms (e.g., botulism). Listeriosis can result in severe meningitis as well as fetal loss for a pregnant woman.

For a chart of common foodborne disease agents, descriptions of associated symptoms and incubation periods, see http://www.doh.wa.gov/notify/other/foodchart.pdf

Additional information regarding foodborne illness agents can be found in:

Centers for Disease Control and Prevention. Diagnosis and Management of Foodborne Illnesses A Primer for Physicians and Other Health Care Professionals. MMWR 2004;53(RR04):1–33. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5304a1.htm

B. Foodborne Disease in Washington State

During recent years, DOH has received approximately 40 to 50 reports of FBD outbreaks per year, involving approximately 400 to 800 ill persons per year. Studies suggest the true burden of FBD is many times higher. Agents causing outbreaks in Washington include *Campylobacter,* norovirus, *Salmonella*, shiga toxin-producing *E. coli*, and other bacterial toxins. During most years, viral agents such as norovirus cause the largest number of FBD outbreaks and the largest outbreaks.

C. Reservoirs

Humans are the reservoir of hepatitis A virus, norovirus, *Shigella* species, *Salmonella* Typhi, *Staphylococcus aureus*, and *Vibrio cholerae*.

Animals are the primary reservoirs of *Brucella* species, *Campylobacter jejuni*, *Cryptosporidium parvum*, shiga toxin-producing *Escherichia coli*, *Giardia, Salmonella* species, *Trichinella spiralis*, and *Yersinia enterocolitica.*

Vibrio parahaemolyticus and *Vibrio vulnificus* are organisms that occur naturally in coastal waters. Shellfish can concentrate these organisms while filter feeding.

Bacillus cereus, *Clostridium* species, heavy metals, and *Listeria monocytogenes* are found in the environment.

D. Modes of Transmission

By definition, FBD agents are transmitted through food, although many of these agents can be transmitted through other routes, such as water, animal contact, or directly person-to-person. Food items can become contaminated with FBD agents in the following ways:

1. **Food items contaminated from nature.**

   Raw contaminated food items that can be made safe by sufficient cooking include improperly canned products containing heat-labile botulinum toxin, foods with bacterial contamination, and animal-derived foods containing parasites. Examples include raw milk or milk products contaminated with *Brucella*, *Campylobacter, Listeria monocytogenes*, *Salmonella* or *Cryptosporidium parvum*; eggs or poultry contaminated with *Salmonella* or *Campylobacter* species; ground beef or wild game contaminated with *E. coli* O157; pork contaminated with *Yersinia enterocolitica*; and bivalve shellfish contaminated with *Vibrio parahaemolyticus.* Wild game meat in this country can contain *Trichinella spiralis*, a parasitic roundworm.

   FBD caused by toxins within fish or shellfish include ciguatera, scombroid, and paralytic shellfish poisoning. These toxins are heat-stabile and, as a result, these FBDs cannot be prevented by cooking contaminated fish or shellfish.

2. **Food items contaminated by an ill food handler**

   Ill food handlers can contaminate food through their feces, vomitus or infected lesions. Outbreaks due to *Shigella,* hepatitis A, and norovirus are generally caused by contamination of uncooked or cooled food by an infected food handler. FBD outbreaks of hepatitis A and norovirus infection have been associated with consumption of raw oysters contaminated with human sewage before harvest or less commonly during processing by ill food handlers. *Staphylococcus aureus* introduced into food from a food handler's infected eye, skin, or nasopharynx can multiply at room temperature and produce a heat-stable toxin not destroyed by subsequent cooking.

3. **Food items cross-contaminated by a contaminated food or the environment**

   Bacteria from animal-derived foods (beef and eggs, for example) can cross-contaminate raw foods through cooking utensils, the hands of food workers, unclean food preparation surfaces, or improper storage. Contaminated water, dirt or sewage can introduce a number of agents into previously safe food.

   Clostridium perfringens and *Bacillus cereus* are found in the environment and may occur in grains or spices. Their spores are not inactivated by routine cooking. Outbreaks caused by these bacteria generally result from holding cooked food at temperatures that allow the bacteria to proliferate (between 45°–140°F, usually).

4. **Food items intentionally contaminated**

   FBD agents can be intentionally added to foods to cause illness.

E. Periods of Communicability

Persons ill from preformed toxins (e.g., *Bacillus cereus*, *Staphylococcus aureus*, botulinum toxin) are not communicable to others. The communicable period of those infected with bacteria, viruses or parasites varies. See agent specific guidelines at:

http://www.doh.wa.gov/notify/forms/**.**

F. Treatment

Though treatment varies with the etiologic agent, most FBD requires only adequate hydration. Antibiotics may be appropriate for some FBD agents. Botulism calls for urgent administration of antitoxin and close observation, generally in an intensive care unit.

Treatment recommendations for specific FBD agents can be found in:

Centers for Disease Control and Prevention. Diagnosis and Management of Foodborne Illnesses A Primer for Physicians and Other Health Care Professionals. MMWR 2004;53(RR04):1–33. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5304a1.htm

G. Susceptibility/Immunity

Most people are susceptible to these agents. Infants and persons with lowered gastric acidity may be infected with lower innocula. Infants, the elderly, and immunosuppressed persons are more likely to suffer serious illness from selected agents. Pregnant women and the elderly are more likely to have severe illness and other complications from listeriosis. Hepatitis A is vaccine preventable.

3. FOODBORNE OUTBREAK DEFINITIONS

A FBD **outbreak** is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food.

Outbreaks of FBD may result from various types of exposure including a point source (e.g., a particular event or food establishment), the widespread distribution of a perishable commodity, or a persistent contamination of a shelf-stable product.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Laboratory Diagnosis

FBD outbreaks may or may not be laboratory confirmed. In general, confirming the specific etiologic agent in an outbreak requires detecting the agent in clinical specimens from at least 2 ill persons. Guidelines for confirming the etiologic agent of a FBD outbreak are available in Appendix A and at: http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm.

B. Tests Available at the Washington State Public Health Laboratories (PHL)

PHL has the capability to test **clinical specimens** for many foodborne bacterial and parasitic pathogens and norovirus. PHL does not test clinical specimens for hepatitis A but this test is widely available in commercial labs. Consult with CDES prior to submitting specimens.

PHL also has the capability to test **food specimens** for many bacterial pathogens, when indicated in the context of an outbreak investigation (e.g., investigations of botulism). Consult with CDES prior to submitting specimens.

For additional information regarding testing clinical and food specimens for common foodborne pathogens at PHL, see *Foodborne Disease and the Public Health Labs: A Foodborne Pathogen Quick Reference Guide for Food Sanitarians* available at: http://www.doh.wa.gov/EHSPHL/PHL/foodguide.pdf

C. Specimen Collection

For instruction regarding collecting and shipping clinical and food specimens to PHL, see *Foodborne Disease and the Public Health Labs: A Foodborne Pathogen Quick Reference Guide for Food Sanitarians* available at:
http://www.doh.wa.gov/EHSPHL/PHL/foodguide.pdf

When submitting commercial food specimens, keep the food item in the original package and include all available documentation regarding the purchase of the item including receipts.

5. ROUTINE INVESTIGATION and CONTROLLING FURTHER SPREAD

Outbreaks can be detected through notifiable condition reporting, speciation and/or molecular analysis of isolates in the laboratory (e.g., pulse field gel electrophoresis [PFGE]) consumer complaints, and syndromic surveillance systems.

A. Systematically collect information from patients to characterize the outbreak.

The DOH Foodborne Illness Investigation Form Part 1 can assist with collecting preliminary information, including the following:

1. Demographics, including name, address, telephone number, age, sex, and other relevant factors such as occupation, residence, classroom, unit/wing/ward, cell block, etc.
2. Symptoms, including vomiting, diarrhea, bloody diarrhea, fever, abdominal cramps, muscle aches, and any others mentioned.
3. Date and time of symptom onset and how long symptoms lasted (duration).
4. Common meals and food and drink consumption history for a period of at least 72 hours before illness onset.
5. Names, addresses, phone numbers, and other locating information of anyone else who might be involved in the outbreak, both people who are sick and people who are not, and the name of the coordinator of a group activity, if applicable.

B. Attempt to identify additional cases. Methods might include sending provider alerts, calling others potentially exposed to the suspected source, and releasing a media alert.

C. Confirm the existence of an outbreak.

Local health jurisdictions should consider a number of questions, including the following:

1. Are there two or more people from different households with the same clinical illness resulting from the ingestion of the same food or meal or from visiting the same commercial establishment?
2. Are the clinical signs and symptoms, along with the incubation period, consistent with an illness resulting from the reported exposure?
3. Are all the illnesses similar and consistent with a known FBD agent?
4. Is the number of illnesses more than what would be expected in this group of people and in the population as a whole?
5. Are there reports of potentially associated cases from multiple sources?

6. Are there other common exposures or contacts among those affected (e.g., personal, occupational) that could explain transmission?
7. Does the demographic information (age, ethnicity, etc.) suggest a common source?

[Note: These questions provide guidance and are not strict criteria.]

D. Facilitate testing of stool specimens from ill persons associated with the outbreak. Formulate a hypothesis about the FBD agent and arrange for appropriate clinical laboratory testing, if necessary.

1. Refer ill persons for clinical evaluation and testing if symptoms are severe, if bloody diarrhea is reported, or if the person is vulnerable to complications due to age or disability.
2. Collect fresh stool and/or vomitus as soon as possible after onset of illness. The sicker people are when specimens are collected, the more likely the etiologic agent will be recovered. See Section 4C for additional details regarding specimen collection.
3. Collect specimens from as many people as possible. The criteria for confirming that an outbreak was caused by a specific agent depend on isolating the agent from at least two people involved in the outbreak.
4. In general, clinical specimens from food handlers should only be collected when they have had an illness compatible with that of cases involved in the outbreak (to ensure that they get appropriate treatment and their disease has resolved); or when humans are the only reservoir for the etiologic agent and it is necessary to identify the source of a confirmed infection (for example, *Salmonella* Typhi). Food handlers often eat at their work site and may be ill simultaneously with patrons.

E. Hold food specimens for possible testing.

If people have specimens of the food they think made them sick, ask that they be stored cold (not frozen) at home in containers that will resist breakage and contain spillage (or offer to store them cold at the local health jurisdiction). Ask that the original wrapper and purchase receipts be saved. Tell them that their food specimens may not be needed for microbiologic testing. For more information regarding testing food specimens, see Section 4.

F. Develop a preliminary case definition that includes time, place, and person.

An example of a case definition follows:

Diarrhea with abrupt onset between December 25 and December 26, 2008 (time) in any person at least 5 years of age (person) who ate supper at Church A on December 25, 2008 (place).

G. Communicate with the environmental health specialist who will conduct the field investigation.

Provide the above information and, if the suspected source of FBD is a local restaurant or other commercial establishment, ask the sanitarian to obtain a menu and conduct a process-focused inspection using the DOH Foodborne Illness Investigation Form Part 2 (available at: http://www.doh.wa.gov/notify/forms/foodoutbreak2.pdf). The goals of the

joint epidemiologic and environmental investigation are to identify the infectious agent in the environment, the mode of transmission, the food vehicle, the source of the contamination and the contributing factors.

Consider the likely infectious agent based on symptoms and incubation period. Consider likely modes of transmission for that agent and the related inspection (see Section 2D). For example, a norovirus outbreak is likely due to an ill food handler with inadequate hand hygiene. In contrast, a *Clostridium perfringens* outbreak is likely to result from food held at inappropriate temperatures. As appropriate, obtain the following additional information from both managers and staff:

1. What are the usual food-handling practices? How long is food prepared in advance? Is food allowed to sit unrefrigerated? For how long?
2. Were there any unusual circumstances or practices operative just before the outbreak began? Power outages? Water back-ups? Other equipment failures?
3. Were food handlers ill during the incubation period of the suspect FBD agent? When did they become ill? With which foods do they work? Do any food workers have cuts on their hands?
4. Do the food workers eat the foods they prepare? (Most ill food workers are victims rather than sources of FBD agents).

H. Implement immediate control measures based on the hypothesized FBD agent, the usual vehicles for this agent and food-handling malpractice that permitted or facilitated transmission.

Depending on circumstances, control measures may include making food handling recommendations to restaurant workers, excluding or restricting a particular worker, closing a restaurant, disposing of contaminated food (after specimens have been collected), or issuing a press release to advise citizens who may develop symptoms.

I. Consider testing hypotheses with an epidemiologic study.

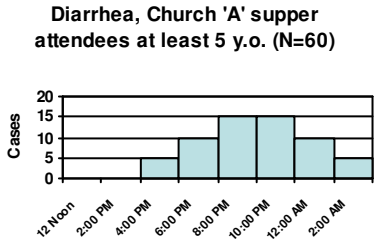
1. Determine if initial interviews and the number of affected persons will support an epidemiologic study.
2. Get as complete a list as possible of all the people who attended the same function, ate at the same restaurant, etc.; lists can be obtained from the event organizer, from credit card receipts or from reservation lists.
3. Obtain a menu from the restaurant or other list of foods served.
4. Develop a questionnaire to systematically collect information on symptoms and exposures.
5. Administer the questionnaire to as many people as possible, both sick and well, as soon as possible after the first cases are reported. It is important to remember that the longer you wait, the less reliable these data are.
6. After finalizing a case definition, analyze the data to obtain the following:

   Demographic profile: the number of cases by age group and sex.

   Symptom profile: the percentage of cases who have vomiting, diarrhea, bloody diarrhea,

fever, abdominal cramps, muscle aches, and any other symptoms.

Epidemic curve: the number of cases by time of onset of symptoms.



Event attack rate: the number of cases divided by the total number of people exposed. Event attack rate can only be calculated if the total number of people exposed is known.

Median incubation period: the time it takes 50% of the cases to get sick after exposure to the FBD agent. The median incubation period can only be calculated if the time of exposure is known.

Food-specific attack rate: the percentage of people who became ill after eating a specific food (table 1, column 4).

Relative risks: the percentage of people who became ill after eating a certain food, divided by the percentage of people who became ill after not eating the same food (table 1, column 8).

***P* value**: The probability the elevated relative risk is due only to chance. *P*<.05 means that chance is a very unlikely explanation (less than 5 times out of a 100) for the difference in relative risks.

Table 1 is an example of a data table using the information collected from a review of consumed food items to identify the likely food item that was contaminated. *P*< .05 is the usual cut-off to say the food is "statistically significantly associated with illness" (table 1, last column).

Table 1. Food-specific attack rates, relative risks and P values, Church A supper attendees at least 5 years old, December 25, 2008

Food Item	DID EAT the Specific Food			DID NOT EAT the Specific Food			Statistics	
	Number Sick	Number Well	Attack Rate	Number Sick	Number Well	Attack Rate	Relative Risk	P value
Turkey	55	45	55%	5	95	5%	11	<.001
Gravy	40	60	40%	20	80	20%	2	.004
Mashed potatoes	42	58	42%	18	82	18%	2.3	.005
Ham	35	65	35%	25	75	25%	1.4	0.1
Pears	30	70	3%	30	70	3%	1	1
Formulas	A	B	A÷(A+B) = X%	C	D	C÷(C+D) = Y%	X%÷Y %	*

* Statistical programs, such as EpiInfo, SAS or SPSS are commonly used to calculate *P* values. Epi Info is a CDC-developed statistical software package available at: http://www.cdc.gov/epiinfo/index.htm.

J. Implement and evaluate further control measures

Depending on additional information, further control measures may include recommendations to the establishment and to food workers, food safety training, , disposal of contaminated food, closing a restaurant, , issuing a press release to advise citizens who may develop symptoms, or notifying state or federal food regulatory agencies. In addition, it will likely involve follow-up verification that work exclusion or changes in food preparation practices have been met.

Patients and contacts should be instructed in good hand washing and food-handling practices. Persons with vomiting or diarrhea should not handle food to be eaten by others. More specific follow-up of cases and contacts varies with the etiologic agent. Please refer to the Surveillance and Reporting Guidelines (http://www.doh.wa.gov/notify/forms/) for guidance for individual reportable diseases and the Washington State Food Code available at: http://www.doh.wa.gov/ehp/food/rule.html

K. Report findings to DOH.

Report all FBD outbreaks to CDES using the DOH Foodborne Illness Investigation Forms Part 1–3. If Part 1 is not used during the investigation, Part 2 and Part 3 should be submitted.

7. ROUTINE PREVENTION

For general food safety tips see: http://www.doh.wa.gov/ehp/food/safetytips.html

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APPENDIX A: CRITERIA FOR CONFIRMATION OF FOODBORNE OUTBREAKS

The Centers for Disease Control and Prevention has established criteria for confirming the etiology when a foodborne outbreak has been identified. These criteria can be found in the following table and at http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm

Table 1: Guidelines for Confirmation of Foodborne Disease Outbreaks

***Tests Available at WA State Public Health Laboratories are indicated by an asterisk**

Etiologic agent	Confirmation Criteria
Bacterial	
1. *Bacillus cereus*	
a. Vomiting toxin	*Isolation of organism from stool of two or more ill persons and not from stool of control patients OR *Isolation of 10^5 organisms/g from epidemiologically implicated food, provided specimen is properly handled
b. Diarrheal toxin	*Isolation of organism from stool of two or more ill persons and not from stool of control patients OR *Isolation of 10^5 organisms/g from epidemiologically implicated food, provided specimen is properly handled
2. *Brucella*	Two or more ill persons and isolation of organism in culture of blood or bone marrow; greater than fourfold increase in standard agglutination titer (SAT) over several wks, or single SAT 1:160 in person who has compatible clinical symptoms and history of exposure
3. *Campylobacter jejuni/coli*	*Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
4. *Clostridium botulinum*	*Detection of botulinum toxin in serum, stool, gastric contents, or implicated food OR *Isolation of organism from stool or intestine
5. *Clostridium perfringens*	*Isolation of 10^6 organisms/g from stool of two or more ill persons, provided specimens are properly handled. OR Demonstration of enterotoxin in the stool of two or more ill persons OR *Isolation of 10^5 organisms/g from epidemiologically implicated food, provided specimen is properly handled
6. *Escherichia coli*	
a. Enterohemorrhagic (*E. coli* O157:H7 and others)	*Isolation of *E. coli* O157:H7 or other Shiga-like toxin-producing *E. coli* from clinical specimen from two or more ill persons OR Isolation of *E. coli* O157:H7 or other Shiga-like toxin-producing *E. coli* from epidemiologically implicated food (**E. coli* O157:H7 only)
b. Enterotoxigenic (ETEC)	Isolation of organism of same serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from stool of two or more ill persons

c. Enteropathogenic (EPEC)	Isolation of organism of same enteropathogenic serotype from stool of two or more ill persons
d. Enteroinvasive (EIEC)	Isolation of same enteroinvasive serotype from stool of two or more ill persons
7. *Listeria monocytogenes*	
a. Invasive disease	*Isolation of organism from normally sterile site
b. Diarrheal disease	Isolation of organism of same serotype from stool of two or more ill persons exposed to food that is epidemiologically implicated or from which organism of same serotype has been isolated
8. Nontyphoidal *Salmonella*	*Isolation of organism of same serotype from clinical specimens from two or more ill persons OR *Isolation of organism from epidemiologically implicated food
9. *Salmonella* Typhi	*Isolation of organism from clinical specimens from two or more ill persons OR *Isolation of organism from epidemiologically implicated food
10. *Shigella* spp.	*Isolation of organism of same serotype from clinical specimens from two or more ill persons OR *Isolation of organism from epidemiologically implicated food
11. *Staphylococcus aureus*	Isolation of organism of same phage type from stool or vomitus of two or more ill persons OR Detection of enterotoxin in epidemiologically implicated food OR *Isolation of 10^5 organisms/g from epidemiologically implicated food, provided specimen is properly handled
12. *Streptococcus*, group A	Isolation of organism of same M- or T-type from throats of two or more ill persons OR Isolation of organism of same M- or T-type from epidemiologically implicated food
13. *Vibrio cholerae*	
a. O1 or O139	Isolation of toxigenic organism from stool or vomitus of two or more ill persons OR Significant rise in vibriocidal, bacterial-agglutinating, or antitoxin antibodies in acute- and early convalescent-phase sera among persons not recently immunized OR Isolation of toxigenic organism from epidemiologically implicated food
b. non-O1 and non-O139	*Isolation of organism of same serotype from stool of two or more ill persons
14. *Vibrio parahaemolyticus*	Isolation of Kanagawa-positive organism from stool of two or more ill persons OR Isolation of 10^5 Kanagawa-positive organisms/g from epidemiologically implicated food, provided specimen is properly handled
15. *Yersinia enterocolitica*	*Isolation of organism from clinical specimen from two or more ill persons OR Isolation of pathogenic strain of organism from epidemiologically implicated food

Chemicals	
1. Marine toxins	
a. Ciguatoxin	Demonstration of ciguatoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten a type of fish previously associated with ciguatera fish poisoning (e.g., snapper, grouper, or barracuda)
b. Scombroid toxin (histamine)	Demonstration of histamine in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten a type of fish previously associated with histamine fish poisoning (e.g., mahi-mahi or fish of order Scomboidei)
c. Paralytic or neurotoxic shellfish poison	*Detection of toxin in epidemiologically implicated food OR Detection of large numbers of shellfish-poisoning-associated species of dinoflagellates in water from which epidemiologically implicated mollusks are gathered
d. Puffer fish, tetrodotoxin	Demonstration of tetrodotoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten puffer fish
2. Heavy metals (Antimony, Cadmium, Copper, Iron, Tin, Zinc)	*Demonstration of high concentration of metal in epidemiologically implicated food
3. Monosodium glutamate (MSG)	Clinical syndrome among persons who have eaten food containing MSG (e.g., usually 1.5 g MSG)
4. Mushroom toxins	
a. Shorter-acting toxins (Muscimol, Muscarine, Psilocybin, *Coprinus artrementaris,* Ibotenic acid)	Clinical syndrome among persons who have eaten mushroom identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushroom or food containing mushroom
b. Longer-acting toxins (e.g., *Amanita* spp.)	Clinical syndrome among persons who have eaten mushroom identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushroom or food containing mushrooms
Parasitic	
1. *Cryptosporidium* spp.	*Demonstration of oocysts in stool or in small-bowel biopsy of two or more ill persons OR Demonstration of organism in epidemiologically implicated food
2. *Cyclospora cayetanensis*	*Demonstration of the parasite by microscopy or molecular methods in stool or in intestinal aspirate or biopsy specimens from two or more ill persons OR Demonstration of the parasite in epidemiologically implicated food

3. *Giardia intestinalis*	*Demonstration of the parasite in stool or small-bowel biopsy specimen of two or more ill persons
4. *Trichinella* spp.	Two or more ill persons and positive serologic test or demonstration of larvae in muscle biopsy OR *Demonstration of larvae in epidemiologically implicated meat
Viral	
1. Hepatitis A	Detection of immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV) in serum from two or more persons who consumed epidemiologically implicated food
2. Norovirus (NoV)	*Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional reverse transcriptase-polymerase chain reaction (RT-PCR) OR Visualization of viruses (NoV) with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens OR Two or more stools positive by commercial enzyme immunoassay (EIA)
3. Astrovirus	Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional reverse transcriptase-polymerase chain reaction (RT-PCR) OR Visualization of viruses (NoV) with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens OR Two or more stools positive by commercial enzyme immunoassay (EIA